

Guidelines for Managing Wildlife Habitats in Southwestern Ponderosa Pine Forests of the United States

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Abstract Forest management practices, particularly timber harvesting activities, affect the habitats of a large number of wildlife species found in southwestern ponderosa pine forests of the United States. Timber harvesting activities and other vegetative treatments often change the relative abundances of food and cover. Wildlife habitats for some wildlife species are benefited, while the habitats for other wildlife species are detrimentally impacted. The guidelines presented in this paper should be helpful to foresters, wildlife managers, and other interested in maintaining or increasing wildlife habitat qualities in the forest ecosystems investigated. While the wildlife species considered are indigenous to the southwestern ponderosa pine forests, many of the wildlife management principles implied in the guidelines are likely to have applications in other ecosystems throughout the world.

Key words: Wildlife, Habitat, Resource, Ponderosa pine forest

Introduction

Ecological relationships and dependence of wildlife species on southwestern ponderosa pine (*Pine ponderosa*) forests are closely related to habitat use. Foraging habits, seasonal food preferences, and use of trees for feeding are largely dependent upon the structure and spatial arrangements of overstory components in these forests. It is not surprising, therefore, that forest management practices, particularly timber harvesting activities, can affect wildlife habitats.

University and government research have been, and continue to investigate wildlife habitat use in southwestern ponderosa pine forests to formulate practical management guidelines for improving wildlife habitats, while manipulating forest stands to meet silvicultural, range, and other multiple use objectives.

This paper represents a summary of these investigations, initiated in 1972, to the present time.

Study areas

Habitat use by a variety of wildlife species has been investigated in ponderosa pine forests on 10 study areas on two sites in north-central Arizona: 6 study areas on the Beaver Creek watersheds, approximately 50 kilometers south of Flagstaff, and 4 study areas in the vicinity of Heber, along the Mogollon Rim, about 65 kilometers north of Phoenix, the capital city of Arizona. These study areas, which ranged from 20 to over 70 hectares in size,

were examined for changes in wildlife habitat use resulting largely from removing various proportions of the ponderosa pine overstory. In addition to ponderosa pine, overstory vegetation consisted of alligator juniper (*Juniperus deppeana*) and Gambel oak (*Quercus gambelii*). Perennial grasses, forbs, and a few shrub species comprised the understory on the study areas.

One of the study areas on the Beaver Creek watersheds was completely cleared of all overstory trees, with the logging residues piled in rows, to furnish a reference-point which was used to compare with less serious treatment. Seventy-five percent of the ponderosa pine overstory was removed from a second study area on Beaver Creek, leaving even-aged groups of trees averaging less than 10 square meters of basal area per hectare. Logging residues were piled in rows, and alligator juniper and Gambel oak were remained in the forest for browse and mast. A third study area on Beaver Creek was treated by clearing the ponderosa pine forests from one-third of the area in irregular strips, and thinning the mediate areas to about 15 square meters of basal area per hectare. The logging residues were piled and burned, and alligator juniper and Gambel oak were left for browse and mast.

A fourth study area on Beaver Creek was treated to increase timber production by thinning ponderosa pine trees of 25 centimeters in diameter and less than about 15 square meters of basal area per hectare, and cutting groups of larger trees in a shelterwood silvicultural system. A fifth study area on Beaver Creek was treated to

increase the habitats for the big-game species in the area, specifically for deer (*Odocoileus hemionus*) and elk (*Cervus elaphus canadensis*), by creating small openings (up to 4 hectares in size). Logging residues were piled and burned in some openings. Some dense stands of ponderosa pine trees of less than 10 centimeters in diameter were retained in the forest for protective and thermal cover, and the remaining stands were thinned to increase their growth. The sixth study area on the Beaver Creek watersheds had been harvested by group selection 20 years before the investigations of wildlife habitat use were initiated. Merchantable ponderosa pine trees were cleared in small groups. Trees in the remaining areas were thinned, and logging residues were piled and burned. The average density of the ponderosa pine trees was nearly 25 square feet of basal area when the investigations began in 1972.

Forest management practices on the 4 study areas in the vicinity of Heber have been, and will continue to be similar to those on the surrounding ponderosa pine forests. Merchantable ponderosa pine trees on all of the study areas had been cut, with the most recent timber harvested by group selection, removing approximately 40 to 60 percent of the merchantable sawtimber. No timber has been cut on the study areas since the early 1960s.

Methods

Field measurements collected in the investigations largely represented indices of wildlife species abundance, and therefore, were assumed to reflect habitat use. Measurements obtained included fecal pellet counts of deer, elk, and cottontail (*Sylvilagus audubini*), utilization of browse plants by deer and elk, counts of twigs clipped by Abert squirrel (*Sciurus aberti*), and observations of nest trees, recapture of small rodent populations, observations of the feeding habits of nongame birds, and recording of fecal materials from *Carnivora*.

The measurements were made on permanent plots located on the 10 study areas. Other measurements taken on these plots were the composition and densities of ponderosa pine, alligator juniper, and Gambel oak trees, composition, production, and utilization of herbaceous species, and physiographic features.

Guidelines

Results of the investigations of wildlife habitat use sug-

gested a variety of forest management practices for simultaneously maintaining or increasing the quality of wildlife habitats for big- and small-game species, small rodent populations, nongame bird populations and carnivorous species in southwestern ponderosa pine forests. One key to achieve this goal is prescribing the diverse treatments to create a mosaic of habitats that are collectively favorable to the wildlife species (Larson, Ffolliott, and Clary 1986). Guidelines are available to satisfy this goal and meet silvicultural, watershed, range, and other multiple use objectives at the same time, include:

1. Small forest openings (2 to 3 hectares in size), either occurring naturally or created by timber harvesting activities, offer food supplies for a number of big- and small-game species and nongame bird populations (Ffolliott, Thill, Clary, and Larson 1977, Larson, Ffolliott, and Clary 1986, Ffolliott 1990). The edge-effects of these openings also increases diversities of wildlife habitats.

2. Thinning of dense ponderosa pine forest stands can create additional foods for deer and elk, while maintaining sufficient protective and thermal cover (Neff 1979, Larson, Ffolliott, and Clary 1986). However, thinning to levels below 10 square meters of basal area per hectare eliminates much of this cover, however.

3. Preferred browse plants should be protected and, when necessary, increased by seeding or planting. Densities of browse plants up to 350-450 stems per hectare are favorable to deer (Larson, Ffolliott, and Clary 1986). Palatable herbaceous species should be seeded to benefit elk on sites where timber has been harvested (Neff 1979).

4. Alligator juniper and Gambel oak components of ponderosa pine forests should be retained to provide food and increase cover diversity. Healthy Gambel oak trees approaching 20 centimeters in diameter should be protected to produce mast crops for Abert squirrels and wild turkey (*Meleagris gallopavo merriami*). Cutting Gambel oak trees of less than 20 centimeter in diameter can stimulate sprouting of browse plants.

5. These for nesting and feeding of Abert squirrel should be retained and protected. These trees are generally 40 to 55 centimeters in diameter (Patton 1975, Ffolliott and Patton 1978, Ffolliott 1990) and occur in clumps of three or more interlocking crowns. When forest management practices altered the spatial arrangements and distributions of trees in a manner detrimental to Abert squirrel, the small-game species moved to preferred locations containing sufficient cover.

6. Cottontail prefer open areas of small cuttings with an abundance of logging residues and thickets of Gambel oak for cover (Ffolliott 1990). Cottontail habitats are also improved by encouraging dense stands of shrub species and herbaceous plants (Costa, Ffolliott, and Patton 1976). An absence of sufficient cover is a limiting factor for cottontail.

7. Thinning of ponderosa pine forest stands and piling of logging residues benefit some small rodent populations by increasing food and cover (Goodwin and Hungerford 1979). However, clearcutting of forest overstories eliminates some species of small rodents, for example, golden-mantled ground squirrels (*Spermophilus lateralis*) and cliff chipmunks (*Eutamias dorsalis*). The treatment of logging residues is important in determining the diversities of small rodent populations.

8. Nongame bird populations are protected by removing only one-sixth to two-thirds of the tree foliage volume in timber harvesting activities and leaving diversified distributions and sizes of tree species (Szaro and Balda 1979). Populations of nongame birds and species diversities are not significantly affected by limited timer removals, but replacement of species takes place when forest overstories are completely cleared.

9. Ponderosa pine snags (dead standing trees) should be protected to provide habitats for cavity-nesting nongame bird species (Ffolliott 1983). It can become necessary to create the needed snags by poisoning living but risk and over-mature trees to obtain the needed habitat conditions in some situations.

10. Carnivores prefer areas where the implementation of forest management practices has increased the abundance of prey species (Turkowski 1980). Increased predator-activity often occurs on sites where logging residues, alligator juniper, and Gambel oak are retained in the ecosystem.

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